

# Development & Implementation of Vegetation Monitoring in the SWAN

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# Evidence for vegetation change

‘It is possible, that in spite of... adverse circumstances, the timber may be advancing [southward] along the peninsula and that it may ultimately extend much farther [south] than now. There are, of course, no data on this subject; and any such would be difficult to obtain, for the growth of individual trees is extremely slow and any general movement could scarcely be detected except by observations at great intervals.’ Osgood (1904)

1918

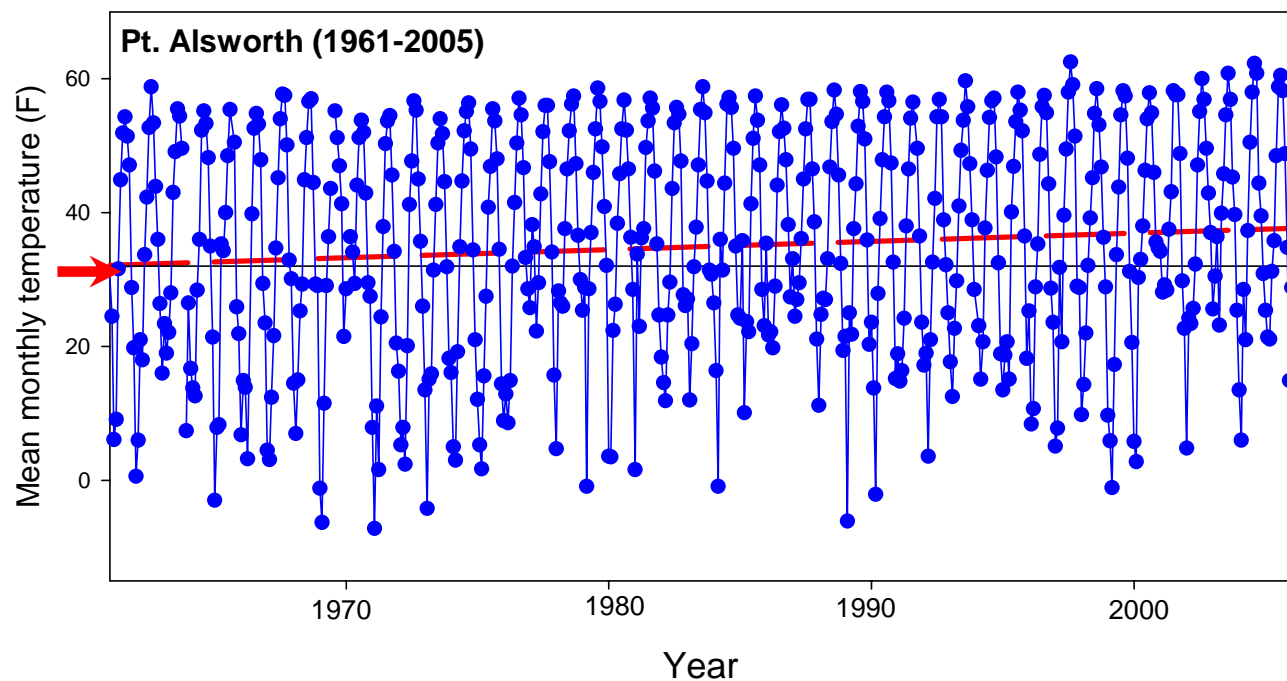
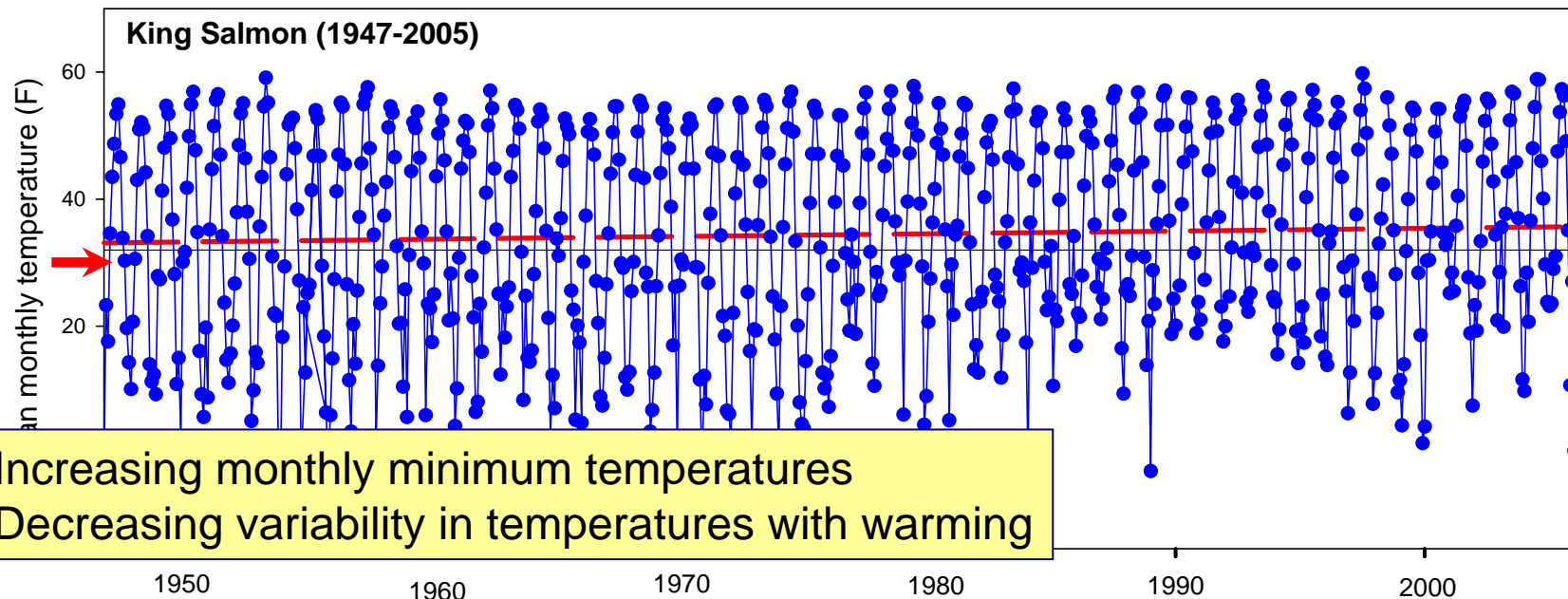


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2005

*Naknek River*







# Questions

- Are **landscape-scale processes** (e.g., start/end of growing season) changing through space and time?
- Are broad **land cover classes** and land use patterns changing across the landscape through time?
- Are community **composition** and **vegetation structure** changing through space and time?
- Is community composition changing through time in areas potentially **sensitive** to environmental change?
- Are **non-native plants** establishing in natural areas?



# **Vegetation monitoring: a tiered approach**

## **Extensive:**

**Insects & Disease - Aerial Surveys (USFS-ADF)**

**Landscape Processes - MODIS**

**Vegetation Composition & Structure - LANDSAT, IKONOS**

## **Intensive:**

**Vegetation Composition & Structure**

**Sensitive Plant Communities**

**Invasive Species**



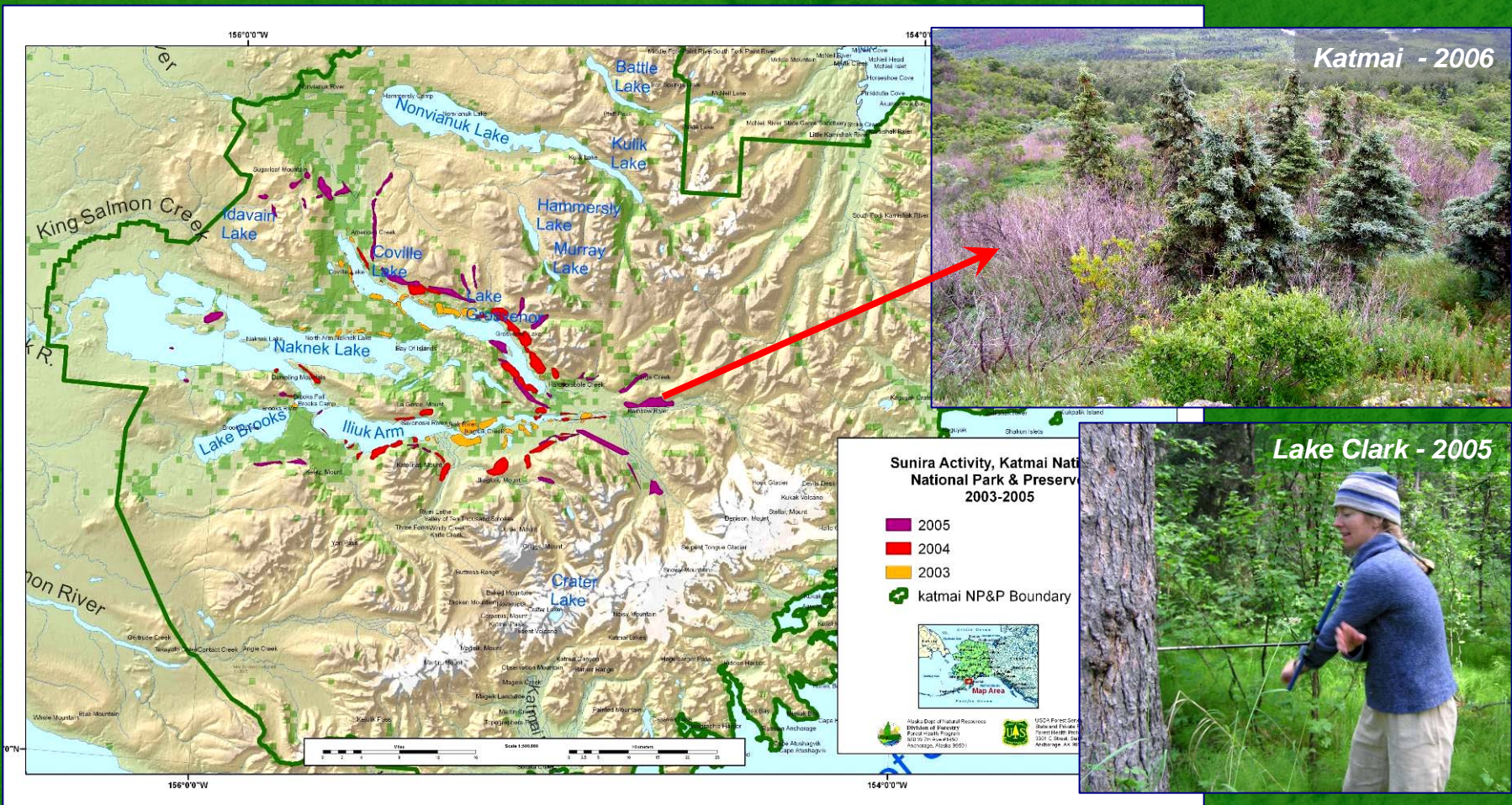
An aerial photograph of a forest landscape. The majority of the area is covered in dense green trees. In the lower right portion of the image, there is a large, irregularly shaped area where the trees have a brownish-orange hue, suggesting a fire scar or a different type of vegetation. The text "Protocol Development: Extensive Monitoring" is overlaid in yellow on the green forest area.

# **Protocol Development: Extensive Monitoring**



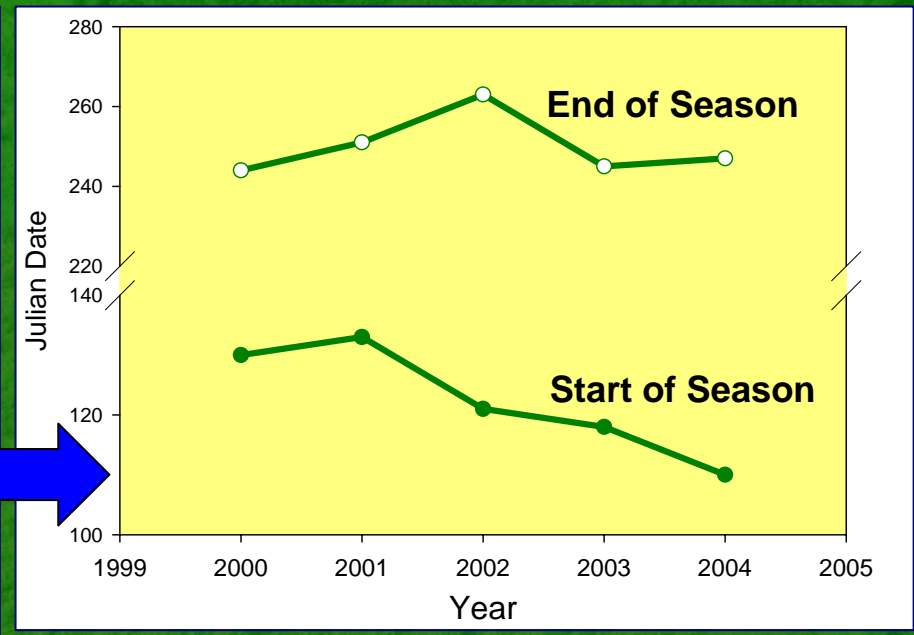
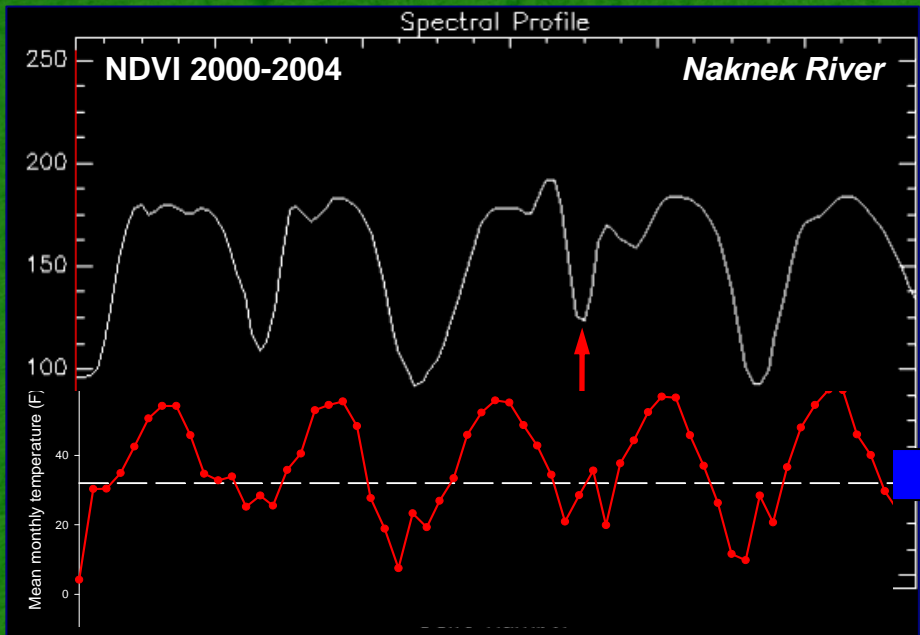
# Forest Insects & Disease

- USFS-ADF data
- Remote sensing
- Tree-ring studies



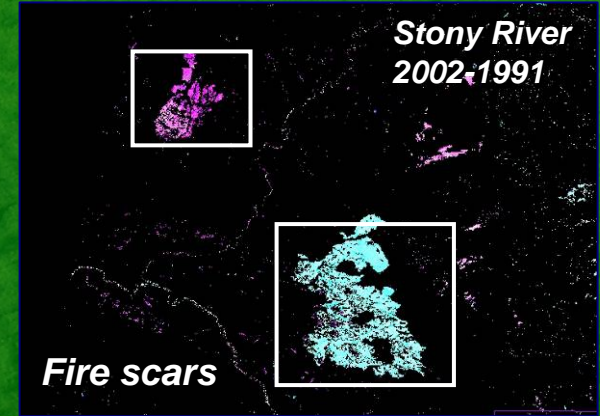
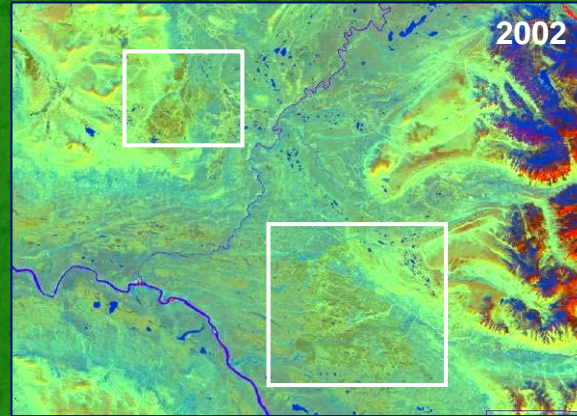
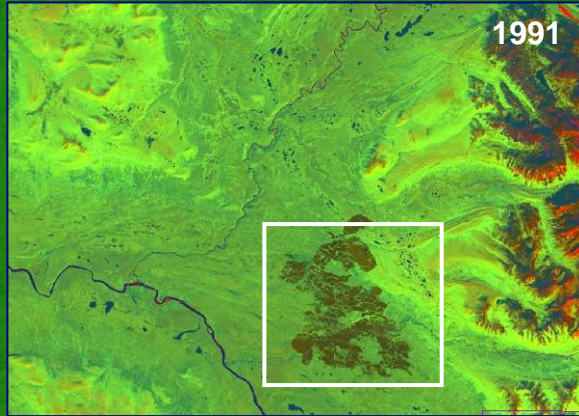


# Landscape Processes





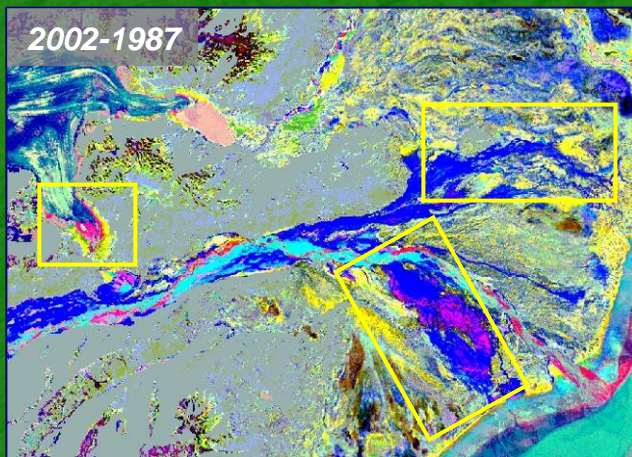
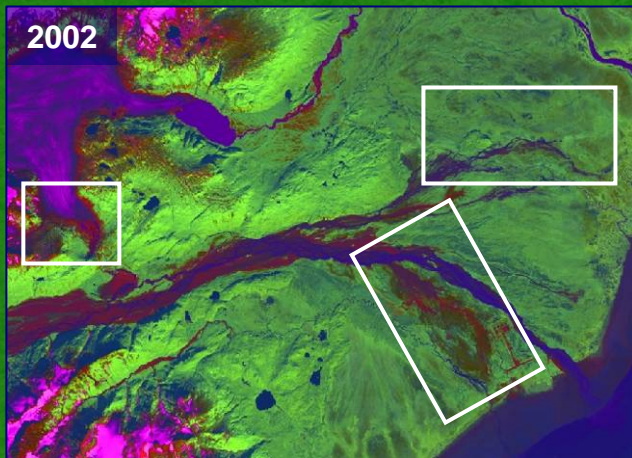
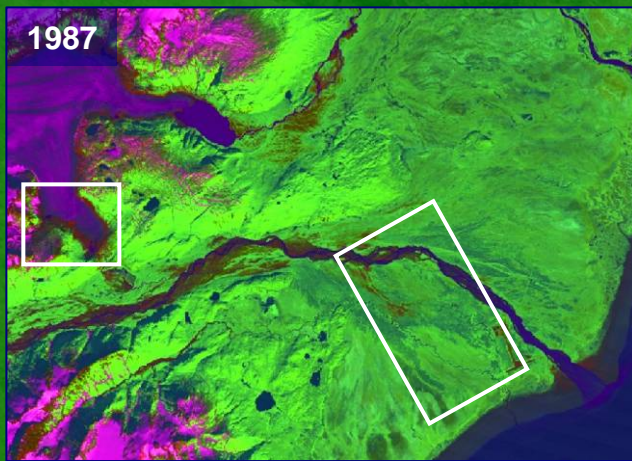
# Vegetation Composition & Structure



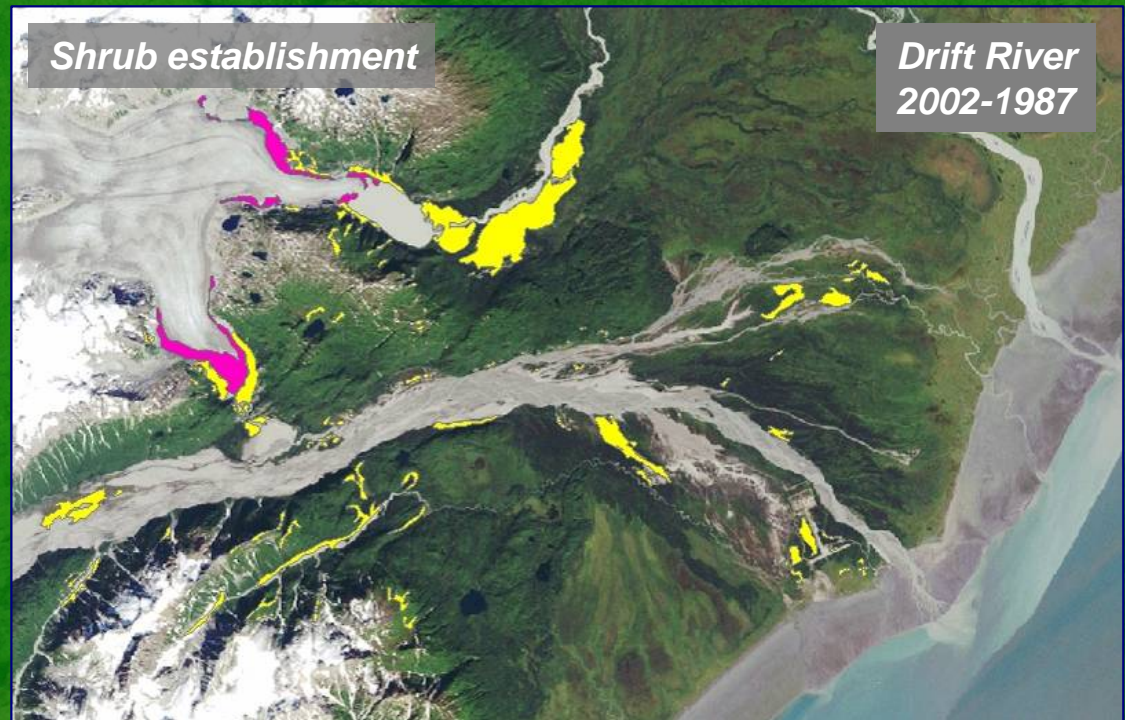
- Forest disturbance
- Vegetation establishment
- Shrub expansion
- Loss of lichen
- Pond drying & formation
- Channel migration

*Cooperators: Robert Kennedy & Warren Cohen, USFS-PNW*





# Vegetation Composition & Structure



Recovery from disturbance



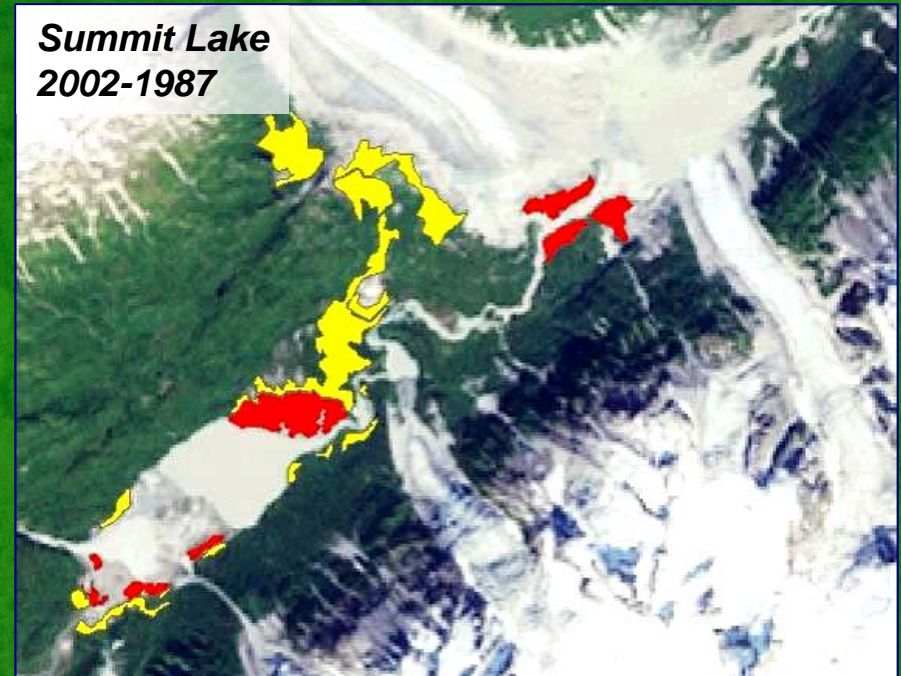
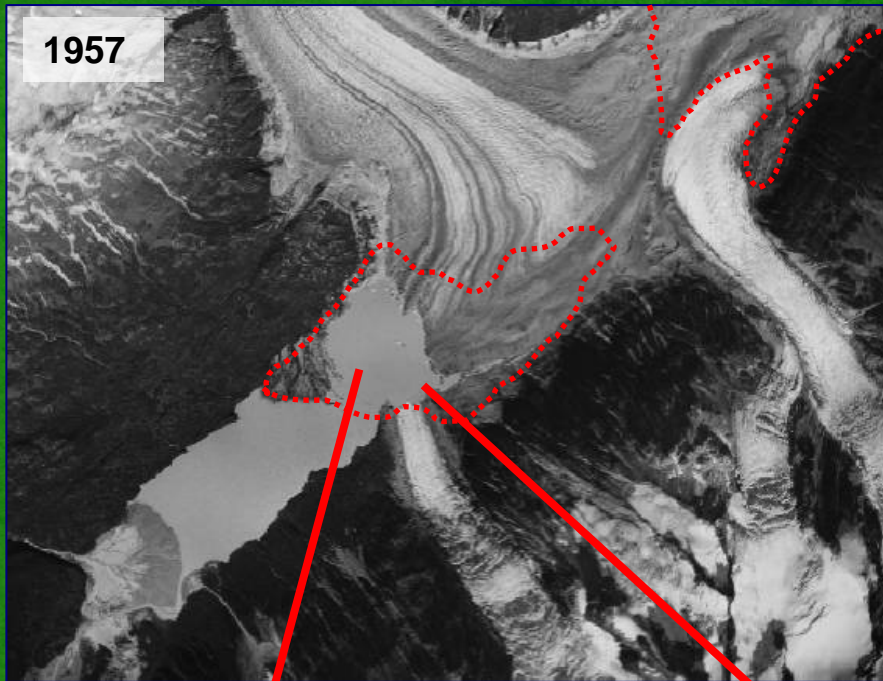
# Vegetation Composition & Structure



**Alder expansion**



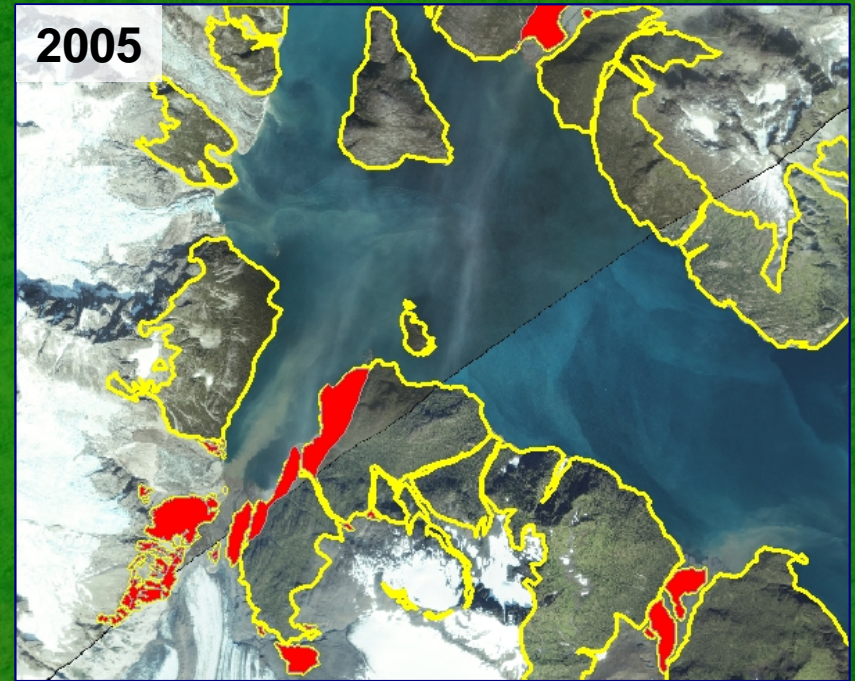
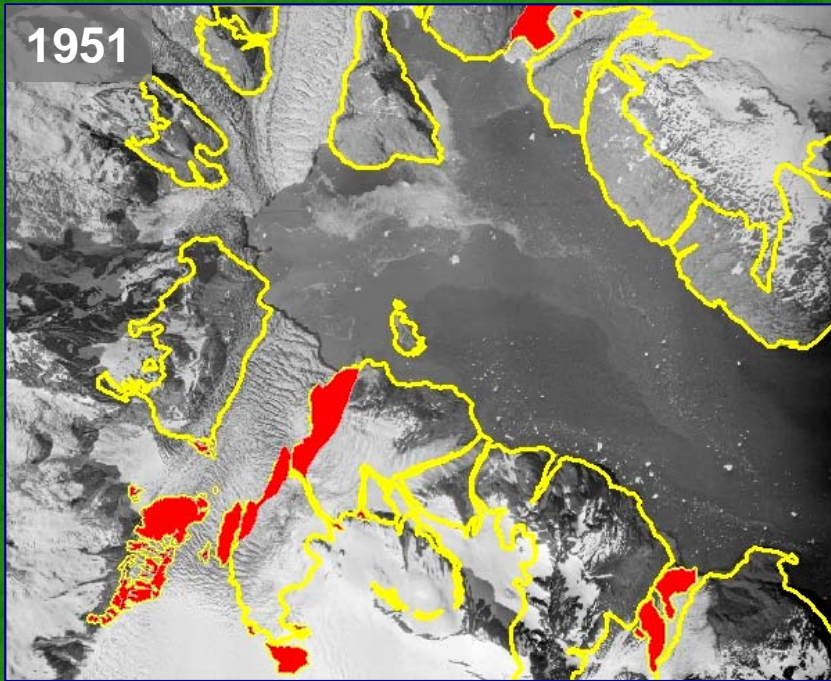
# Vegetation Composition & Structure



**Glacial retreat**



# Vegetation Composition & Structure



**Glacial retreat**  
(IKONOS)



An aerial photograph of a forest landscape. The majority of the area is covered in dense green trees. In the lower right portion of the image, there is a large, irregularly shaped area where the trees have a brownish-orange hue, suggesting a fire scar or a different type of vegetation. The text "Protocol Development: Intensive Monitoring" is overlaid in the center-left area in a bold, yellow font.

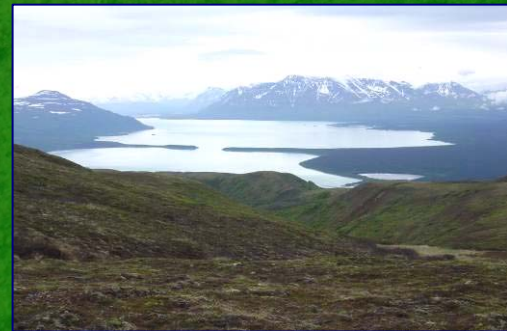
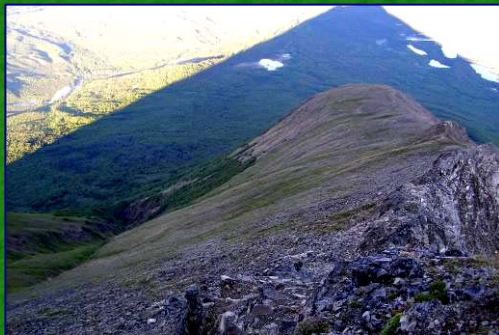
# **Protocol Development: Intensive Monitoring**



# **Vegetation composition & structure: Index sites**

- **Easy access**
- **Co-located with weather stations**
- **Sampled frequently**

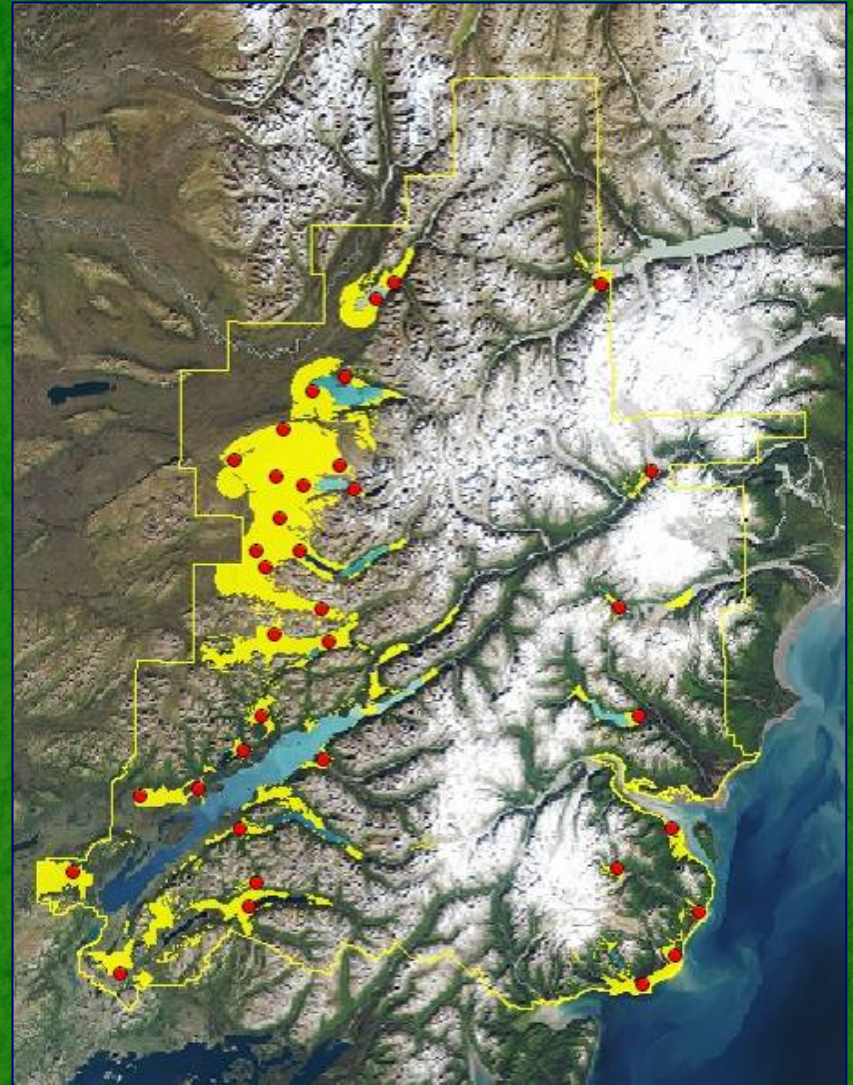
e.g., Tanalian Mt. (LACL), Harding Icefield (KEFJ), Dumpling Mt. (KATM)





# Vegetation Composition & Structure

- GRTS design
- Restricted by access
- Stratified by elevation
- Sampled less frequently





# Sensitive Plant Communities

- Targeted locations
- Restricted by access
- High, low elevations
- Sampled less frequently

e.g., nunataks (LACL, KEFJ), salt marsh (LACL, KATM)



*Harding Icefield 2005*



An aerial photograph of a forest landscape. The image shows a mix of green and brownish-green patches, likely representing different types of vegetation or forest health. The text is overlaid in the center.

# **Protocol Development: 2007 Work Plans**



**Insects & Disease:**  
historic beetle disturbance



**Sensitive plant communities:**  
salt marsh



**Vegetation composition & structure:**  
pilot sampling





# Pilot sampling: Vegetation composition & structure

- Clustered plots – efficiency
- Replication
- Validation of change classes
- Design ~ NCCN
- Variables ~ CAKN
- Transects v. plots





## **What we're learning:**

- Dynamic systems – widespread change
- Sensitive areas emerging on landscape
- Unanticipated patterns of vegetation change

## **and what we still need to figure out:**

- How to get the most out of field sampling?
- How to integrate multiple information sources?



